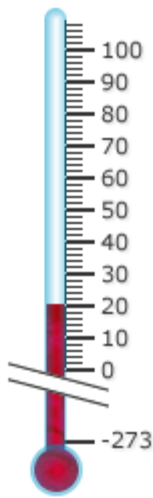


# 08 Fraction operations

## FAHRENHEIT VERSUS CELSIUS

We can measure many magnitudes directly. For example, a length, a weight. We only have to compare the object with our unit of measurement.

### Celsius



But for temperatures we can only measure by their effects. For example, the expansion of heat produces in a fluid (e.g. mercury) is a way to determine the temperature.

### Celsius scale

Our temperature scale is centigrade scale. It comes from the Swedish astronomer Celsius (1742). This scientific took as reference the freezing point of water (0°C) and the boiling point of water (100°C).

### Fahrenheit scale

But there is another scale very used in the US. This is the Fahrenheit scale. This unit of temperature (°F) was invented by the German physicist Daniel Gabriel Fahrenheit (1724). He was the inventor of the mercury thermometer too.

Fahrenheit transformed another previous scale invented by the Danish astronomer Romer (1701).

In summary, the Fahrenheit scale has the new reference points:

0°F: the temperature of freezing point of brine.

32°F: the temperature of freezing water.

96°F: the temperature of human body –approximately-.

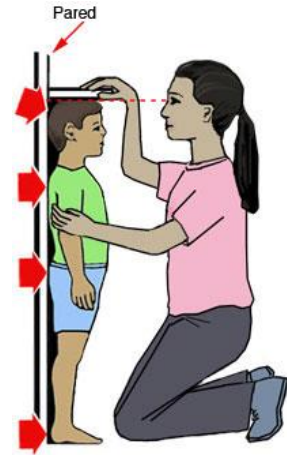
212°F: the temperature of boiling water.

Fahrenheit is used in the United States for everyday applications. For example: weather forecasts, food cooking, and freezing temperatures.

Brine is a mixture of ice, water, and ammonium chloride –a chemical compound- at a 1:1:1 ratio. This mixture stabilizes its temperature automatically in –17.78 °C independently of the environment temperature.

## FORMULA FOR CELSIUS TO FAHRENHEIT

There is a way to change Celsius or centigrade temperatures into Fahrenheit. The formula is thus:  $F = \frac{9}{5} \cdot C + 32$



## 1. ADDING AND SUBTRACTING FRACTIONS

Like fractions have the same denominator.

$\frac{7}{3}$ ;  $\frac{-5}{3}$  and  $\frac{2}{3}$  are *like* fractions.  $\frac{7}{5}$  and  $\frac{-5}{3}$  are *not like* fractions.

Adding and subtracting fractions is a process of collecting together like fractions.

If the denominators are the same (like fractions) then just add or subtract the numerators.

$$\frac{7}{3} + \frac{-5}{3} = \frac{2}{3}$$

When the denominators are different we have to form equivalent fractions to make the denominators the same. This process is the reduction to common denominators.

Example:

Reduce to common denominator:  $\frac{7}{5}$  and  $\frac{2}{3}$

Now, you are ready to sum the two fractions:

$$\frac{7}{5} + \frac{2}{3} =$$

The best way to reduce to common denominators is to find the lcm of the denominators:

$$-\frac{2}{9} - \frac{1}{6} + \frac{3}{4} = -\frac{\quad}{\quad} - \frac{\quad}{\quad} + \frac{\quad}{\quad} =$$

$$lcm(9; 6; 4) = 36$$

Example:

Calculate the resulting fraction by reducing to common denominator:

$$\frac{5}{8} - \frac{5}{6} + \frac{7}{12} = -\frac{\quad}{\quad} - \frac{\quad}{\quad} + \frac{\quad}{\quad} =$$

$$lcm(8; 6; 12) =$$

### **Opposite fraction**

It is the fraction we get by changing the sign:

$$\text{Opposite of } \frac{7}{3} =$$

$$\text{Opposite of } \frac{-2}{3} =$$

## 2. MULTIPLYING AND DIVIDING FRACTIONS

The product of two fractions is the fraction that has as the numerator the product of two numerators and as the denominator the product of two denominators.

$$\frac{6}{7} \times \frac{-3}{10} = \text{———}$$

The division of two fractions is the fraction that has as the numerator the product of the first numerator by the second denominator and as the denominator the product of the first denominator by the second numerator.

$$8 \div \frac{10}{13} = \text{———} =$$

### ***Inverse fraction***

It is the fraction we get by swapping the numerator for the denominator

$$\text{Inverse of } \frac{7}{3} =$$

$$\text{Inverse of } \frac{-2}{3} =$$

### ***Fraction as operator***

We can use a fraction as an operator too.

A fraction of a quantity is the result to divide the quantity (the whole part) into the denominator and multiply the result by the numerator.

**3/5 of 80 €**

**80 : 5 = 16; 3 x 16 = 48 €.**

We can always change the word 'of' by 'multiplied' to calculate. This is a quicker way to calculate:

$$\frac{3}{5} \cdot 80 = \frac{3 \cdot 80}{5} = \frac{240}{5} = 48.$$

Example:

We get  $\frac{2}{15}$  of cream from milk. How many litres do we get from 300 litres of milk?

## EXERCISES AND PROBLEMS

### 1. ADDING AND SUBTRACTING FRACTIONS

1. Evaluate:

1)  $\frac{5}{6} - \frac{1}{2}$       2)  $\frac{1}{8} + \frac{2}{5}$       3)  $\frac{4}{5} - \frac{2}{3}$       4)  $\frac{3}{4} + \frac{5}{6}$       5)  $\frac{11}{15} - \frac{5}{12}$

2. Calculate:  $-3 - \frac{2}{5} + \frac{3}{4}$

3. Calculate:  $3 + \frac{5}{4} - \frac{7}{2} =$

4. Calculate:  $-3 + \frac{2}{5} - \frac{5}{8} =$

### 2. MULTIPLYING AND DIVIDING FRACTIONS

5. Evaluate, giving answers in simplest form

1)  $\frac{1}{5} \times \frac{4}{7}$     2)  $\frac{4}{9} \times \frac{2}{3}$     3)  $\frac{3}{12} \times \frac{4}{5}$     4)  $\frac{6}{7} \times \frac{3}{10}$     5)  $\frac{5}{8} \times 16$     6)  $6 \times \frac{5}{8}$

6. Evaluate, giving answers in simplest form

1)  $\frac{2}{3} : \frac{7}{10}$       2)  $\frac{1}{6} : \frac{5}{6}$       3)  $\frac{3}{4} : \frac{1}{5}$       4)  $\frac{5}{9} : 10$       5)  $8 : \frac{10}{13}$

7. Calculate:  $\frac{1}{4} + \left(\frac{2}{3} - 1\right) : \left(\frac{1}{2} - \frac{1}{3}\right) =$

8. Calculate:  $\frac{2}{3} - \left(1 + \frac{1}{5}\right) \cdot \left(\frac{4}{3} - 1\right) =$

9. Calculate: a)  $2 - \frac{5}{6} + \frac{1}{4}$ ; b)  $\left(-1 + \frac{3}{4} - \frac{1}{3}\right) : \left(2 - \frac{1}{4}\right)$

10. Work out the following and simplify the resulting value:  $\left(\frac{-5}{3} \cdot \frac{2}{6} + 8\right) : \left(\frac{5}{3} - 4 \cdot 3\right)$

11. Work out the operation giving the result as a fraction:  $-\frac{3}{2} \cdot (4 - 3 \cdot (-4)) + \frac{5}{3} : 2 - 5$

12. Work out the operation giving the result as a fraction:  $-\frac{4}{7} \cdot (-3 - 2 \cdot (-4)) + \frac{5}{3} : 2 - 5$

13. Calculate:  $\frac{-7}{5} + \left(-2 + \frac{1}{3}\right) : \left(\frac{4}{7} - 2\right) =$

14. Calculate:  $\left(\frac{2}{7} - \frac{3}{5}\right) : \left(\frac{3}{2} \cdot 10 - 7\right) + \left(\frac{-3}{5}\right) : (-6) =$

**15.** Calculate:  $\frac{-2}{7} - \left(-3 + \frac{2}{5}\right) \cdot \left(\frac{4}{7} - 1\right) =$

**16.** Work out and simplify the result as much as possible:  $\frac{1}{2} : \left[ \frac{1}{5} - 4 \cdot \left(2 - \frac{4}{9}\right) \right] =$

### 3. Problems

**17.** A tap fills  $\frac{2}{5}$  of a tank in an hour and another fills  $\frac{1}{3}$  of it in an hour.

a. Draw the tank and the part filled in by each tap.

b. What part do they fill in an hour together?

c. What portion is empty after an hour?

**18.** It takes a worker 4 hours to place the floor in a room. Another worker makes that in 3 hours.

a) What part of the floor does the first worker put in an hour?

b) If they work together, what part of the floor do they put in an hour?

**19.** How many bottles  $\frac{3}{4}$  l does a winemaker need to pack 600 l of wine?

**20.** Work out:  $\frac{2 - \frac{5}{3}}{\frac{2}{3} - 7} - \frac{\frac{-3}{5}}{1 - \frac{8}{7}} =$

**21.** Get the resulting fraction:  $\frac{\frac{5}{3} - \frac{2}{7}}{\frac{2}{3} \cdot 10 - 7} - \frac{\frac{-3}{5}}{6} =$

**22.** Calculate the resulting fraction:  $\frac{\frac{3}{-5} \cdot (-2)}{4 - \frac{1}{2}} + \frac{-\frac{1}{2}}{\frac{12}{5}} =$

**23.** Get the resulting fraction:  $\frac{\frac{3}{5} - 7}{\frac{2}{3} + \frac{4}{5}} - \frac{2}{5 - \frac{7}{3}} =$

**24.** Get the resulting fraction:  $\frac{\frac{2}{7} - \frac{3}{5}}{\frac{3}{2} \cdot 10 - 7} + \frac{\frac{-3}{5}}{-6} =$